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Reconsidering the AMU
— What is the optimal basket currency for Asia? —*

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Abstract

AMU (Asian Monetary Unit) is a database constructed by Ogawa and Shimizu (2005) and made available on the RIETI website. The AMU basket weights are based on intraregional trade shares and GDP. However, 20 years have passed since its introduction, and the economies of Asian countries, and particularly China's, have developed significantly. Consequently, it has become necessary to review the weights of the AMU basket. The purpose of this paper is to examine which combinations of current Asian currencies form an optimal currency area by using the G-PPP Model, and to explore other possibilities to construct a new basket weight for the AMU.

Based on prior research, we confirmed that incorporating factors such as each country's financial openness, exchange rate policy, the share of invoice currencies in intra-regional trade, the share of intra-regional FDI, and the degree of production networks and value chains within the region yielded more balanced weights for the basket. This approach better reflects the current economic conditions in the region.

Keywords: common currency basket, regional integration, OCA, financial openness, exchange rate policies, invoice currency, inward FDI, vertical trade, primary income
JEL Classification: F23, F31, F33

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1. Introduction

In the global economy, amid President Trump's introduction of reciprocal tariffs since the start of 2025, the importance of regionalism—deepening economic ties within specific regions—is increasing, shifting away from globalization. Since the late 2010s, significant changes in trade and investment flows have been observed across Asia, especially in East Asian countries such as China and Japan, as well as in Southeast Asian nations, driven by U.S.-China political and security dynamics. Specifically, regarding the currencies used for trade and investment, while transactions invoiced in US dollars and settlements using US dollars remained dominant for cross-border transactions within Asia, including those by Japanese companies, there has been a gradual trend toward promoting transactions denominated in local currencies, not only in China but also in some ASEAN countries (Shimizu et al. 2022).

If Asian local currencies, such as the yen and RMB, are used more widely in intra-Asian trade, stabilizing exchange rates among them will become a critical policy challenge. Similar to the European Monetary System's use of the ECU before the introduction of the euro, Asia could create its own currency basket, akin to the ECU, and implement stable exchange-rate coordination policies relative to it. As a candidate of Asian ECU, we can propose the Asian Monetary Unit, AMU, which was constructed by Ogawa and Shimizu (2005) to provide its data on the RIETI website since 2005. The AMU basket weight is based on the method used by the European Currency Unit (ECU) prior to the introduction of the Euro. In addition, they developed the AMU deviation indicator for each Asian currency, which measures the extent to which each currency deviates from its benchmark rate. This indicator is proposed to serve as a surveillance tool for exchange rate coordination policies within the region.

Twenty years have passed since the AMU was created. The economies of China and other Asian countries have made significant advances. Trade structures and supply chains have also expanded, leading to increased capital transactions within the region. Then, we wonder whether the current AMU weighting accurately reflects the current economic and trade environment of Asian countries. Since the 2000s, Asian integration has progressed beyond trade to encompass FDI, financial integration, and the movement of people. As mentioned above, the stability among Asian currencies is becoming a more critical policy issue. To coordinate exchange rates among Asian currencies, it is necessary to reconsider what factors should determine the basket currency weights for the AMU.

Accordingly, this paper aims to explore new possibilities by examining what is needed to develop a new basket weight for the AMU. To verify the necessity of intra-regional currency coordination using the AMU, we first assessed the level of regional integration and the extent

of Optimum Currency Area (OCA) conditions among the 14 countries of ASEAN plus Japan, China, South Korea, and Hong Kong. Then, referencing previous research on Asian currency baskets, we analyzed four potential elements for new basket weights. We show how incorporating new items would affect the AMU basket weights.

The structure of this paper is outlined as follows. Section 2 discusses the calculation of the AMU basket weight and its development from 2005 to the present. Section 3 analyses data on the degree of integration within Asia and presents the results of an analysis of OCA conditions using the G-PPP model. Section 4 reviews previous research on the Asian basket currency. Section 5 examines the new factors proposed for the AMU basket weight based on their respective data. Section 6 separately discusses how to capture the production networks and value chain expanded within the region. Section 7 summarizes the impact of these new factors on the AMU basket weight based on the findings from Sections 5 and 6. Finally, Section 8 provides the conclusions and future research directions.

2. AMU Calculation and Changes in Basket Weight

After the Asian currency crisis in 1997-1998, the monetary authorities in East Asian countries have been strengthening their regional monetary cooperation. This monetary cooperation following the crisis led to the Chiang Mai Initiative (CMI), which later evolved into the Chiang Mai Initiative Multi-lateral (CMIM), and was initiated by the ASEAN+3 (Japan, Korea, and China) as a network of bilateral and multilateral swap arrangements to address currency crises in member countries. The CMI urges the region's monetary authorities to closely monitor exchange rate movements. Ogawa and Shimizu (2005) proposed a framework for constructing and developing an Asian Monetary Unit (AMU) and AMU Deviation Indicators as surveillance indicators within the region. Ogawa and Shimizu (2005) calculate the AMU as a weighted average of East Asian currencies following the method used to calculate the European Currency Unit (ECU) and the AMU Deviation Indicators, which show the degree of deviation from the hypothetical benchmark rate for each of the East Asian currencies in terms of the AMU.

Table 1. AMU Basket Weight

(revised in 1/2025****, benchmark year=2000/2001)

	Trade volume* %	GDP measured at PPP** %	Arithmetic average shares % (a)	Benchmark exchange rate*** (b)	AMU weights (a)/(b)
Brunei	0.26	0.07	0.17	0.589114	0.0028
Cambodia	0.61	0.18	0.40	0.000270	14.6296
China	35.27	61.57	48.42	0.125109	3.8702
Indonesia	5.37	8.01	6.69	0.000113	592.0354
Japan	14.60	12.27	13.44	0.009065	14.8207
South Korea	12.42	5.38	8.90	0.000859	103.6088
Laos	0.34	0.14	0.24	0.000117	20.5128
Malaysia	6.72	2.27	4.50	0.272534	0.1649
Myanmar	0.57	0.61	0.59	0.159215	0.0371
Philippines	1.50	2.28	1.89	0.021903	0.8629
Singapore	8.80	1.48	5.14	0.589160	0.0872
Thailand	5.60	3.11	4.36	0.024543	1.7744
Vietnam	7.95	2.64	5.30	0.000072	735.4167

* : The trade volume is calculated as the average of total export and import volumes in 2020, 2021, and 2022, taken from DOTS (IMF).

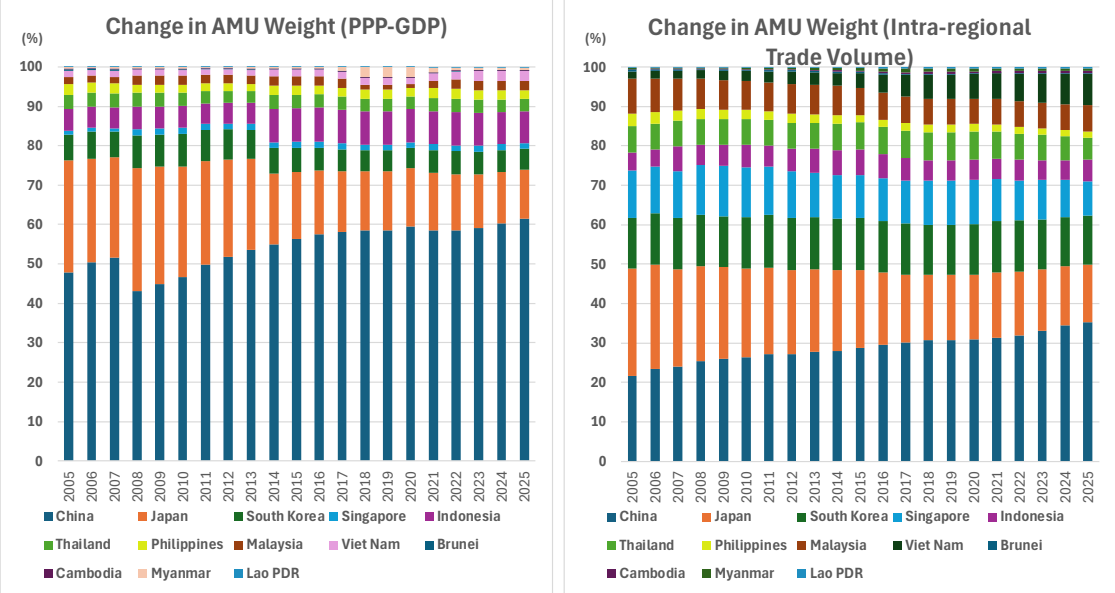
**: GDP measured at PPP is the average of GDP measured at PPP in 2020, 2021, and 2022, taken from the World Development Report, World Bank.

*** : The benchmark exchange rate ($-euro/Currency) is the average of the daily exchange rate in terms of US$-euro in 2000 and 2001.

**** : AMU shares and weights were revised in January 2025.

Table 1 shows the latest basket weights of AMU. The AMU basket weights are based on countries' respective shares in GDP measured at PPP and in trade volumes (exports and imports), reflecting the most recent trade relationships and economic conditions of the 13 East Asian countries. AMU weights are calculated using arithmetic averages based on the share of intra-regional trade over the past three years and on GDP measured using purchasing power parity (PPP). PPP-GDP was adopted because, given the high proportion of emerging economies among member countries, PPP is considered a better reflection of the true state of affairs than nominal GDP. Furthermore, the AMU is quoted against a weighted average of the US dollar and the euro, as both the United States and the EU are significant trading partners of East Asia. The weighted average of the US dollar and the euro is based on trade volumes of East Asian countries with the United States and the euro area at that time, with weights of 65% and 35%, respectively, for the US dollar and the euro.

Figure 1. Change in AMU Basket Weights (2005-2025)



Authors' calculation（Data：RIETI, https://www.rieti.go.jp/users/amu/detail.html）

Figure 1 shows the changes in AMU basket weights from 2005 to 2025. Based on PPP-GDP shares, Japan's share declined significantly from 28.3% (2005) to 12.3% (2025) over these two decades, while China's share rose from 47.9% to 61.5%. Similarly, for intra-regional trade, Japan's share decreased from 28.3% to 12.3%, while China's share increased from 21.7% to 35.3%. While these changes reflect the heightened prominence of the Chinese economy over the past two decades, they may not fully reflect the current situation, particularly given that Japan's decline in its intraregional trade share is largely due to the relocation of Japanese companies' production bases to Asia.

Twenty years have passed since the AMU was created. The economies of China and other Asian countries have experienced significant growth, leading to a surge in capital flows within the region. As mentioned, trade structures and supply chains have expanded, and so measuring trade shares within the region alone has become insufficient to reflect the reality of these expanded supply chains within Asia. Furthermore, capital flows within the region are also becoming more active, and such data should be considered as basket weights.

Furthermore, despite China's dominance in both PPP-GDP share and intra-regional trade share, the RMB's usage within the region has not advanced. Comparing this to the relationship between Germany and Europe before the introduction of the euro, when the Deutschmark served as Europe's key currency, it remains true that the RMB is still far from becoming a regional anchor currency. One reason the RMB has yet to become Asia's central currency is the persistence of capital controls and the lack of transparency in monetary policy. When calculating the basket weight for a common Asian currency, it will likely be necessary

to incorporate indicators of each country's capital controls, i.e., financial openness. With these points in mind, we proceed with the analysis below.

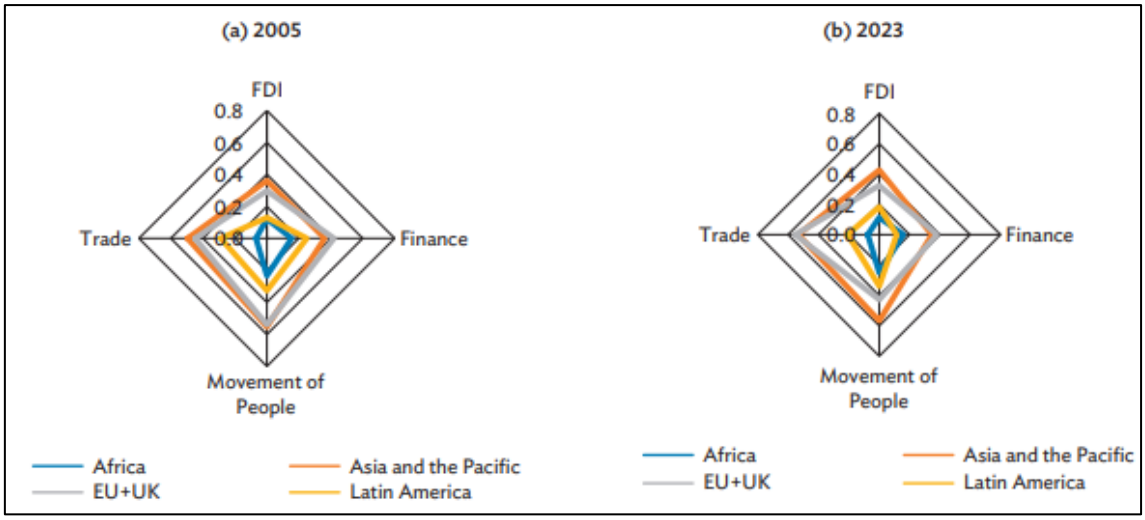
3. Checking Regional Integration and OCA condition

This section first examines the current state of regional integration within Asia by comparing intra-regional trade shares with those of other regions and then analyzes the degree of OCA condition among Asian countries using the G-PPP Model.

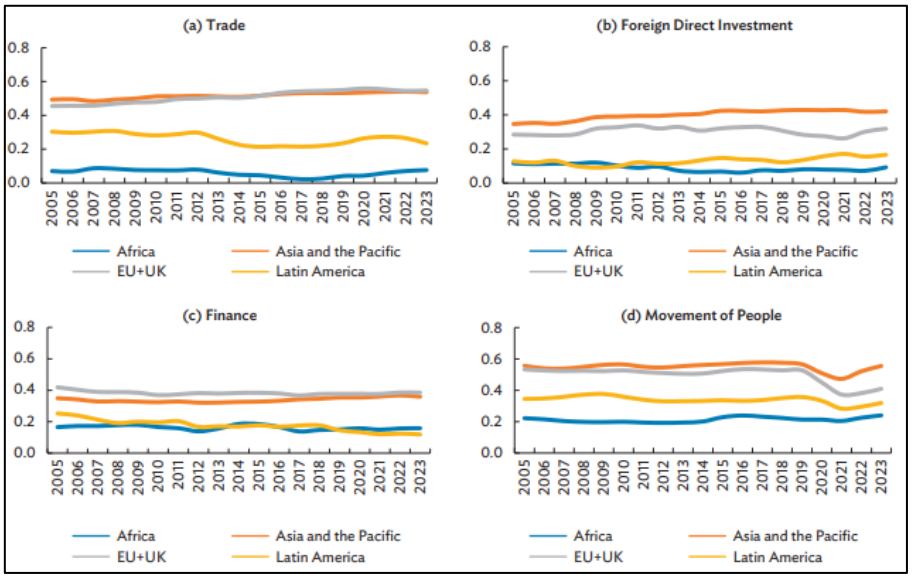
3-1. Regional Integration

According to the ADB's Regional Integration Index[1], Asia and the Pacific have achieved trade integration comparable to that of the EU. However, their integration in terms of Trade is less advanced than that of the EU and the UK. In contrast, FDI is more advanced than in other areas in 2023.

Figure 2. Regional Integration Index by Dimension, 2005 and 2023



[1] Asia refers to the 49 members of the Asian Development Bank (ADB) in Asia and the Pacific, which include Australia, Japan, and New Zealand in addition to 46 developing economies.



Source: Asian Economic Integration Report 2025 (https://aric.adb.org/pdf/aeir/AEIR2025_complete.pdf)

Looking at the intra-regional trade share within ASEAN+4 in 2024(Table 2), exports account for 43.7% and imports for 44.8%, which falls short of the EU. One reason for this is the high share of external trade for China, Japan, and South Korea. Intra-regional trade shares between Hong Kong and China are the highest, at around 70%, and trade among ASEAN countries themselves is approximately 60%.

Table 2. Intra-regional Trade Share within ASEAN +4 (China, HK, Japan, and Korea) in 2024

	Export	Import
Brunei Darussalam	69.3%	49.9%
Cambodia	31.7%	90.3%
Hong Kong	71.9%	69.1%
China, P.R.: Mainland	32.9%	29.1%
Indonesia	56.2%	63.8%
Japan	43.6%	42.6%
Korea, Republic of	45.6%	42.5%
Lao PDR	87.1%	88.5%
Malaysia	56.4%	55.9%
Myanmar	61.4%	87.2%
Philippines	60.1%	71.0%
Singapore	62.3%	44.1%
Thailand	48.5%	57.2%
Vietnam	40.2%	72.4%
Total	43.7%	44.8%

Authors' calculation. All trade data are from CEIC.

3-2. OCA condition by the G-PPP Model

The degree of economic integration within East Asia can also be empirically assessed from a macroeconomic perspective. This paper employs the generalized purchasing power parity (G-PPP) model to detect whether countries satisfy the conditions of the Optimum Currency Area (OCA) or not.

Let's consider the possibility of a policy zone where member countries coordinate their monetary policies to stabilize the value of their currencies. For countries in such a zone or alliance, it's crucial that short-term exchange rate misalignments eventually—at least in the long run—move toward equilibrium levels reflected by economic fundamentals. When considering a currency system that presumes a central parity for exchange rate interventions—one that reflects equilibrium exchange rates based on each country's macroeconomic fundamentals—it is essential that the macroeconomic structures of the member countries meet the so-called "optimum currency area" criteria.

3-2-1. What is the G-PPP Model

The G-PPP model can detect the presence of a multilateral long-run relationship, characterized by common stochastic trends among a specific group of real exchange rates. [2]

Here, following the theoretical background of the G-PPP model proposed by Kawasaki (2012), we assume that n countries, denoted as 1, 2, ..., n, are expected to form a common currency area. The Asian country i has trade relationships with $n-1$ Asian countries and has also strong trade relationships with the European countries and the US. The real effective exchange rate (REER) of country i composed of these trade partners, can be expressed as follows:

$$ree_i = \left(\eta_{i,1} re_{i,1} + \eta_{i,2} re_{i,2} + \cdots + \eta_{i,n} re_{i,n}\right) + \left(\eta_{i,EU} re_{i,EU} + \eta_{i,US} re_{i,US}\right) \qquad (1)$$

where re denotes the real exchange rates between country i and country j: $(i \neq j)$ in logarithms and η denotes the trade weight of country i with partner countries.

Given $re_{j,k} = re_{j,US} - re_{k,}$, the REER of n countries can be expressed in a vector as follows:

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[2] The G-PPP model was originally developed by Enders and Hurn (1994) and modified by Kawasaki and Ogawa (2006).

$$\mathrm{ree}_{US}^{1,\dots n} = \overline{\mathrm{ree}} + \widetilde{\mathrm{ree}} = \mathbf{F} \cdot \mathrm{re}_{US}$$

where $\overline{\mathbf{ree}}$ represents a stationary component and $\widetilde{\mathbf{ree}}$ represents a non-stationary component, $\mathbf{F}$ is a matrix, which defines the trade weights composed of $(\mathbf{F_1}, \mathbf{F_2})$, and $\mathbf{re}$ is the real exchange rate of country i vis-à-vis the US dollar.

If a null matrix $\mathbf{Z}$ for which satisfies: $0 < rank(\mathbf{Z}) < n$ exists, then $\mathbf{Z} \cdot \mathbf{F} \cdot \mathbf{re} = 0$ holds, indicating linear combinations (cointegrating relationships) of the real exchange rates exist. Hence,

$$\mathrm{Z} \cdot \mathrm{F} \cdot \mathrm{re}_{us} = \mathrm{Z} \cdot \left(\mathrm{F}_1 \cdot \mathrm{re}_{US} + \mathrm{F}_2 \cdot \mathrm{re}_{EU,US}\right) = 0 \qquad (2)$$

where

$$\mathrm{Z} = \alpha' \beta$$

and β suggests the cointegrating vector. [3]

3-2-2. The result of the G-PPP Model

This paper calculates the OCA for Asia in two parts. First, following Kawasaki and Ogawa (2006), we perform calculations using a sample of 9 Asian countries (Singapore, Thailand, Indonesia, Malaysia, the Philippines, Vietnam, Japan, China, and South Korea). We then verify the changes observed in the latest results (Jan 2016–Dec 2024) compared with the past results reported by Kawasaki and Wang (2006) and Kawasaki (2019). Second, considering the expansion of supply chains in Asia, we calculate the OCA using a sample of 12 countries: those above nine plus Taiwan, Hong Kong, and India.

- The results of the G-PPP Model with nine countries

At first, we use nine countries, Japan, China, Korea, Singapore, Thailand, Indonesia, Malaysia, the Philippines, and Vietnam as a sample country. We assume that the nine selected East Asian countries, or a subset of these countries, can establish a common currency area. We also assume that the number of countries in a common market is between 5 and 9 ($5 \leq n \leq 9$).

The monthly real exchange rate is calculated from monthly nominal exchange rates and the consumer price index (CPI) from the IMF's International Financial Statistics Online. Our sample in this paper covers the period from January 2016 to December 2024.

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[3] Our estimation to detect cointegrating relationships is employed by the M-TAR model developed by Enders and Siklos (2001). We also conducted the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) unit-root tests for all variables prior to the cointegration analysis.

Table 2 presents our empirical results and compares them with those of the previous two studies.[4] We found 17 combinations in which the G-PPP holds among the possible candidates; hence, some of the nine ASEAN countries may have come closer to the OCA compared to the result from the prior Asian crisis period: 1984:01-1997:6. However, we identified fewer combinations that the G-PPP holds compared to the period 2008:01-2016:12.

Table 3 also indicates the frequency with which each East Asian country can be included in the OCA. While Japan and China appear in 9 of 17 combinations, Korea, the Philippines, Thailand, and Vietnam are primarily included in them. Indonesia, Malaysia, and Singapore are included in only 5 or 6 out of 17 combinations. For these countries, the possibility of inclusion in the OCA is decreasing compared to the period 2008:01-2016:12.

Table 3：Summary of cointegration tests: How frequently each East Asian country is included?

Authors' calculation

Figures 3 (3-1, 3-2, and 3-3) illustrate the OCA's centered position among nine Asian countries, with the names of the nine countries placed outside the nonagon. Given that the countries are ranked by G-PPP, we connect adjacent points in the name with lines and fill the polygon with color.

[4] Kawasaki and Wang (2015) and Kawasaki (2019). Kawasaki and Wang (2015) applied only eight East Asian countries to the prior Asian crisis period due to the lack of data in Vietnam.

Figure 3: How does the OCA expand in East Asia?

Figure 3-1: 1984:1-1997:6 †

Figure 3-2: 2008:9-2016:12 † †

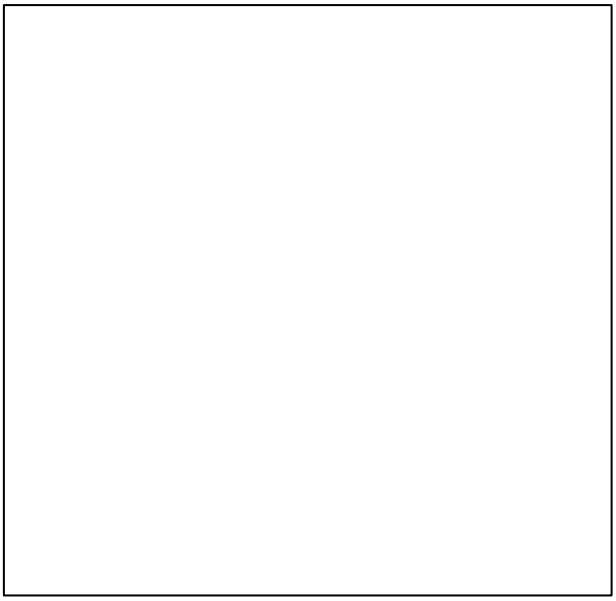
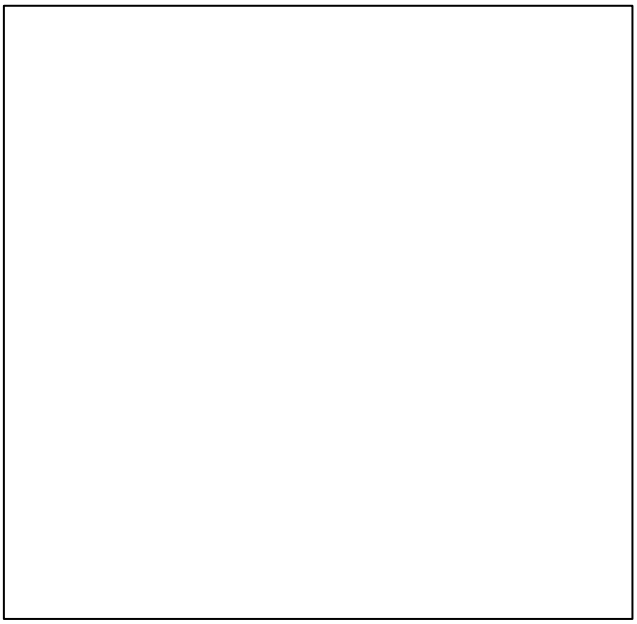


Figure 3-3: 2016:1-2024:12



Authors' calculation

†: Kawasaki and Wang (2015)　† †: Kawasaki(2019)

Figure 3-1 displays the empirical results for eight Asian countries from 1984:01 to 1997:06. While the previous study found that four combinations: JPY-RMB-KRW-IDR-THB-MYR-PHP, JPY-RMB-KRW-THB-MYR-PHP, JPY-KRW-SGD-THB-PHP, and JPY-RMB-KRW-MYR-PHP, bind the G-PPP holds, hence, four overlapped polygons are drawn inside the nonagon. The center of the dark-colored area is on the right side of the nonagon.

Figure 3-2 displays the empirical results from 2008:09 to 2016:12. The previous study identified 26 combinations where the G-PPP holds. The overlapped polygons are drawn as a darker and more widely spread area than in Figure 3-1; therefore, the OCA has expanded to cover the entire nonagon.

Figure 3-3 presents our empirical results from January 2016 to December 2024. We found that there is no direct line between China and Singapore, and the center of the darkly colored area may have shifted to the upper-left part of the nonagon.

We can confirm that the OCA still extends across the entire East Asian region in the context of the G-PPP measure. However, the shift in the darkly colored area in Figure 3-3 may reflect recent changes in international trade, macroeconomic policy, or financial transactions among these Asian countries.

- The results of the G-PPP Model with twelve countries

Next, we add Taiwan, Hong Kong, and India to the previous sample countries and perform

the same analysis. We assume that the twelve selected East Asian countries, or a subset of these, can form a common currency area. We also assume that the number of countries in a common market is between 7 and 9 ($7 \leq n \leq 9$). The sample covers from January 2016 to June 2025.

Table 4：Summary of cointegration tests for 12 countries: How frequently each East Asian country is included?

Authors' calculation

Table 4 presents the results of our extended empirical analysis. We conducted cointegration tests on 1,507 possible combinations and identified 51 cointegrating relationships. Using 12 countries significantly changed the results. With only 9 countries, Japan, China, and South Korea held comparatively substantial influence. However, in 12 countries, the share held by Singapore, the Philippines, and Vietnam increases significantly relative to Japan, China, and South Korea. On the other hand, India's and Hong Kong's presence was less significant than expected, and Taiwan's influence appeared comparable to Japan's.

Singapore's exchange rate policy—particularly its basket currency system—seems to significantly affect the results. In other words, the more diverse the types and characteristics of the included countries, the more economies using a basket currency system benefit from stable exchange rate fluctuations in foreign transactions and increased flexibility in OCA calculations. This supports the basket-currency theory. Regarding the Philippines and Vietnam, recent shifts in supply chain production bases may have caused more significant changes than in Thailand or Malaysia. Indonesia also seems to be catching up with the

Philippines and Vietnam, suggesting significant changes in Southeast Asia's economy over the past 20 years.

In summary, using the G-PPP Model, we confirm that the OCA conditions are not met in all sample countries, but we found that some combinations (7 to 9 countries out of 12) meet the OCA conditions. Increasing the number of Asian sample countries reaffirmed that the importance of countries integrated into supply chains—such as Vietnam—is a key factor in generating OCAs in Asia. Regarding countries, China surpassed Japan in the number of OCA combinations, confirming China's position as the center of Asia.

4. Previous research on basket currency weights

In this section, we review previous research on basket currency weights, especially concerning Asian currencies. While some references do not discuss basket weights for forming a regional common currency, they highlight the concept as a helpful tool for determining currency weights in an Asian currency basket.

Han (2000), written immediately after the Asian currency crisis of 1997-98, demonstrates that both goals can be achieved simultaneously by combining an optimal set of currency basket weights with an optimal fiscal policy. This approach allows an economy to insulate its trade balance and aggregate price level from changes in the real exchange rates of third countries. This paper examines the relationship between currency basket weights and price levels, utilizing the Consumer Price Index (CPI). The CPI is influenced by the prices of non-traded goods and imports, which are affected by the exchange rates of currencies in the basket.

Yoshino, Kaji, and Suzuki (2004), who investigate the optimal exchange rate regime for small open economies such as Asian countries, argue that a basket-peg with trade weights is not always optimal, as it requires frequent adjustments and may not achieve the desired outcomes. While a basket peg can reduce the need for intervention and spread the impact of exchange rate changes, its benefits depend on trade diversification and optimal weight calculations, both of which are complex and challenging to implement. A dollar-peg is best for stabilizing the exchange rate against the dollar, while a floating regime is ideal for maintaining monetary policy autonomy, provided it is used wisely. In conclusion, countries must carefully evaluate their goals and economic context to select the most suitable regime.

Shioji (2006) examines the effects of various pricing regimes on East Asia's trade balance, GDP, and welfare. There are three pricing policies: Producer Currency Pricing (PCP), Local Currency Pricing (LCP), US Currency Pricing (UCP), and Invoicing Currency Pricing (ICP) .

・ Producer Currency Pricing (PCP)

- A monetary expansion in Japan leads to a trade deficit in Asia (around 6% of GDP), while a monetary expansion in the US leads to a surplus.
- A 50:50 basket weight between the yen and the dollar stabilizes the trade balance.

・ Local Currency Pricing (LCP)
- Asia's trade balance remains virtually unaffected by monetary policies in Japan or the US.
- Since prices are independent of shocks, the choice of exchange rate regime has little effect.

・ US Currency Pricing (UCP)
- A monetary expansion in Japan leads to a trade deficit in Asia, while a US monetary expansion leads to a surplus, though the effects are weaker than under PCP.
- A basket weight of approximately 80% for the yen is required to stabilize the trade balance.

・ Invoicing Currency Pricing (ICP)
- Similar to UCP but incorporates more realistic invoicing currency shares.
- A basket weight of approximately 80% for the yen stabilizes the trade balance.

Then, Shioji (2006) concludes that ICP is superior to other pricing regimes for Asia because it accounts for the USD's dominant role in invoicing, provides more realistic insights into trade dynamics, and facilitates the design of more effective exchange rate policies to stabilize the trade balance and other economic variables.

Xu (2011) presents the following factors determine the optimal weights of a currency basket:

・ Structure of Vertical Trade
- Elasticity of Substitution between Imported Intermediate Goods and Domestic Labor: A Higher elasticity increases the importance of stabilizing the import currency.
- Share of Intermediate Goods: A higher share of intermediate goods in traded goods production increases the weight of the import currency.

・ Trade-off between Export Revenue and Import Cost Stability

・ Price Rigidity

・ Exchange Rate Policies in Other Countries
- The choice of weights depends on whether other Asian economies peg their currencies to the US dollar or adopt flexible exchange rate regimes.

・ Impact of External Shocks

Among the above factors, vertical trade plays a critical role in determining the composition of currency baskets for small open economies. In vertical trade, one currency is

used to invoice imported intermediate goods (the import currency), while another is used to invoice exported finished goods (the export currency). So there is a trade-off between revenue and cost stability. Exchange rate fluctuations in the export currency affect export revenue, while fluctuations in the import currency affect the cost of intermediate goods. Therefore, the optimal currency basket balances these trade-offs to minimize consumption and labor volatility. The impact of trade structure also matters. The structure of vertical trade, such as the share of intermediate goods in production and the elasticity of substitution between imported inputs and local labor, significantly influences the optimal currency weights in the basket. Additionally, regional and global linkages play a crucial role. Vertical trade links economies through production networks, making the exchange rate policies of other countries (e.g., pegging to the US dollar or adopting flexible regimes) relevant. These linkages affect export demand and the stability of trade flows. Xu (2011) concludes that for economies heavily involved in vertical trade, both the import and export currencies play crucial roles in determining the optimal currency basket. This is particularly relevant for East Asian economies, where vertical trade is a dominant feature.

Finally, McCauley and Chang (2018) indicate that recent RMB policies have significantly influenced the co-movement between the RMB and other Asian and emerging-market currencies. Trade links significantly influence currency co-movement by aligning the economic and financial dynamics of trading partners. In addition to the trade links, McCauley and Chang (2018) point out that financial links play a crucial role in influencing currency co-movement by connecting economies through investment flows, portfolio behavior, and market correlations. For example, cross-border investment flows, such as FDI and portfolio investments, lead to closer currency co-movement with the RMB. Not only do cross-border investments, stock market correlation, bond market connection, and portfolio behavior affect the linkage between the RMB and other Asian currencies. The above financial links create interdependencies that drive currency co-movement, especially in regions with strong economic and financial ties.

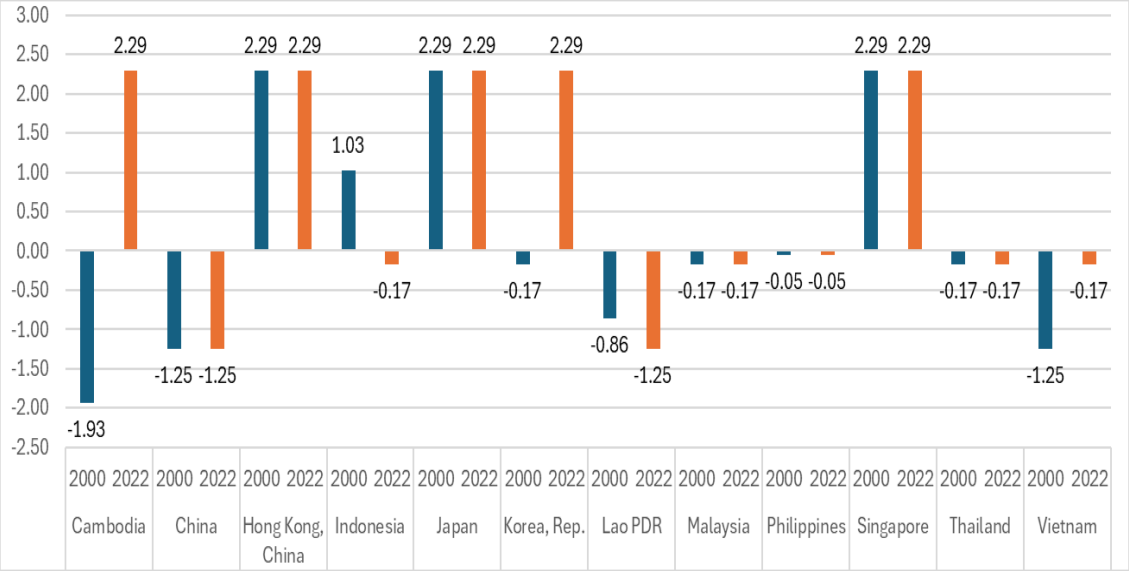
5. Considering Basket weights from several factors

In this paper, we build on the previous research mentioned above, focusing on the following factors as currency basket weights in Asia: the status of capital and financial restrictions (financial openness) in each country, exchange rate policies, the share of invoice currency in intra-regional trade, and cross-border investment flows. For each factor, we create data representing it and examine the current situation in the ASEAN+4 countries.

5-1. Status of Capital Control and Financial Openness

As discussed in section 2, if we focus on the reason why the RMB has yet to become Asia's central currency, which is the persistence of capital controls, we need to consider this point. One of the most popular ways to measure a country's degree of capital account openness is the Chinn-Ito index (KAOPEN), introduced in Chinn and Ito (2006). *KAOPEN* is based on the binary dummy variables that codify the tabulation of restrictions on cross-border financial transactions reported in the IMF's *Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER).*

Figure 4. Change of the Chinn-Ito index (*KAOPEN*) in 2000 and 2022



Source: The Chinn-Ito index, KAOPEN (https://web.pdx.edu/~ito/Chinn-Ito_website.htm)

Figure 4 illustrates the change in the Chinn-Ito index (KAOPEN) between 2000 and 2022. The index provides insight into how countries have liberalized or restricted their capital accounts over time. A higher KAOPEN value indicates greater openness to international financial flows, while a lower value suggests more restrictions. Japan has maintained a relatively high level of capital account openness since the late 1990s. The KAOPEN index for Japan remained stable and high from 2000 to 2022, reflecting consistent policies supporting financial integration and openness to cross-border transactions. The same condition was kept in both Singapore and Hong Kong. South Korea's KAOPEN index showed a notable increase from 2000 to 2022. In 2000, Korea had some restrictions on capital flows, but over the two decades, the country implemented reforms to liberalize its capital account, resulting in a higher KAOPEN value by 2022. On the other hand, China's KAOPEN index was low in 2000,

reflecting strict capital controls and limited openness to international financial flows. Over the years, China gradually relaxed some restrictions, however, compared to the other countries listed, China's capital account remains relatively less open, with ongoing controls still in place. Interestingly, Cambodia has gradually implemented reforms to liberalize its financial sector and encourage foreign investment. As a result, the KAOPEN index for Cambodia has increased significantly by 2022.

5-2. Estimating Exchange Rate Policies

An empirical method widely used to analyze the actual exchange rate regimes adopted by East Asian monetary authorities is the approach developed by Frankel and Wei (1994). This method determines the composition weights of an implicit currency basket using the following regression equation. For each factor, we generate representative data and examine the situation in the ASEAN+4 countries, excluding Japan, which uses a free-floating currency system.

$$\Delta e_{i/k,t} = \alpha_0 + \sum_{h=1}^{n} \alpha_h \Delta e_{h/t,t} + \varepsilon_{i,t} \quad (3)$$

Here, e denotes the exchange rate (natural logarithm), i represents each country's currency, k is the numerator currency, n is the number of currencies assumed to constitute the basket, and ε is the error term. $\Delta e_{i/k,t}$ is the logarithmic difference of each currency relative to the numerator, approximating the rate of change (quarter-on-quarter). Therefore, equation (3) expresses the rate of change of the target Asian currency relative to the *numeraire* as a weighted average of the respective rates of change of multiple currencies, also relative to the numeraire, which are considered to constitute the basket. This process measures weight. In equation (3), if only one of the estimated coefficients is significant and equals 1, the currency is considered to be pegged to the currency with the coefficient of 1. If multiple coefficients are significant and their sum is nearly equal to 1, the currency is considered to be under a basket currency system. If none of the estimated coefficients α are significant, the currency is judged to be under a fully floating exchange rate system. In this analysis, we use the US dollar, the Euro, the Japanese yen, the RMB, and the Australian dollar as reference currencies in the basket[5]. We divided the sample period into two segments: 2017-2019 and 2023 to July

[5] In this regression model, the simultaneous inclusion of the highly correlated US dollar and RMB raises concerns about multicollinearity. To address this, future analyses will incorporate instrumental variables and employ methods such as two-stage least squares. While the New Zealand dollar was used as the numeraire, similar results were obtained using the Swiss franc or British pound.

2025. For each period, the correlations of each Asian currency with the five major currencies were estimated, and the observed changes were analyzed.

Table 5. Estimating the De facto currency basket of Asian Currencies

Country	Currency	2017-2019		2023-2025	
China	USD	0.6889 ***	(0.0623)	0.6621 ***	(0.0389)
	JPY	0.0599	(0.0497)	0.1044 ***	(0.0311)
	EURO	0.1650 **	(0.0644)	0.1044 **	(0.0524)
	AUD	0.1115	(0.0693)	0.1758 ***	(0.0568)
Brunei	USD	0.3045 ***	(0.0407)	0.3125 ***	(0.0379)
	JPY	0.0930 ***	(0.0226)	0.1191 ***	(0.0184)
	EURO	0.2190 ***	(0.0308)	0.2471 ***	(0.0304)
	CNY	0.1508 ***	(0.0390)	0.1403 ***	(0.0464)
	AUD	0.2039 ***	(0.0325)	0.1060 ***	(0.0335)
Cambodia	USD	0.9622 ***	(0.0636)	0.9996 ***	(0.0339)
	JPY	0.0173	(0.0353)	0.0008	(0.0165)
	EURO	0.0087	(0.0482)	-0.0371	(0.0271)
	CNY	0.0092	(0.0611)	0.0148	(0.0415)
	AUD	-0.0062	(0.0508)	0.0380	(0.0299)
Indonesia	USD	0.4549 ***	(0.0884)	0.3357 ***	(0.1015)
	JPY	0.0010	(0.0491)	0.0836 *	(0.0493)
	EURO	-0.0802	(0.0670)	0.1332	(0.0812)
	CNY	0.3208 ***	(0.0849)	0.3371 ***	(0.1242)
	AUD	0.2698 ***	(0.0706)	0.1295	(0.0896)
South Korea	USD	0.3009 **	(0.1367)	-0.1408	(0.1168)
	JPY	0.1017	(0.0759)	0.3093 ***	(0.0567)
	EURO	0.0893	(0.1035)	0.1666 *	(0.0934)
	CNY	0.1219	(0.1312)	0.2924 **	(0.1428)
	AUD	0.4918 ***	(0.1092)	0.3303 ***	(0.1031)
Lao PDR	USD	0.9637 ***	(0.0296)	0.8261 ***	(0.0771)
	JPY	0.0152	(0.0164)	0.0302	(0.0375)
	EURO	0.0436 *	(0.0224)	0.0491	(0.0617)
	CNY	-0.0116	(0.0284)	0.0987	(0.0944)
	AUD	-0.0336	(0.0237)	0.0973	(0.0681)

Country	Currency	2017-2019		2023-2025	
Malaysia	USD	0.4011 ***	(0.0651)	0.1035	(0.0968)
	JPY	0.0069	(0.0361)	0.1232 *	(0.0470)
	EURO	0.1438 ***	(0.0493)	0.0677	(0.0774)
	CNY	0.3976 ***	(0.0624)	0.5041 ***	(0.1184)
	AUD	-0.0021	(0.0520)	-0.0238	(0.0854)
Philippines	USD	0.8372 ***	(0.0911)	0.4412 ***	(0.0902)
	JPY	-0.0377	(0.0506)	0.0607	(0.0438)
	EURO	-0.0185	(0.0690)	0.1198 *	(0.0721)
	CNY	0.1280	(0.0874)	0.2854 **	(0.1103)
	AUD	0.0054	(0.0728)	-0.1670 **	(0.0796)
Singapore	USD	0.3156 ***	(0.0463)	0.3368 ***	(0.0409)
	JPY	0.1165 ***	(0.0257)	0.1220 ***	(0.0199)
	EURO	0.1939 ***	(0.0350)	0.2137 ***	(0.0327)
	CNY	0.1512 ***	(0.0444)	0.1184 **	(0.0500)
	AUD	0.2220 ***	(0.0369)	0.1239 ***	(0.0361)
Thailand	USD	0.4415 ***	(0.0788)	-0.1066	(0.1044)
	JPY	0.1922 ***	(0.0437)	0.2072 ***	(0.0507)
	EURO	0.1100 *	(0.0597)	0.0835	(0.0836)
	CNY	0.0385	(0.0756)	0.4951 ***	(0.1277)
	AUD	0.1678 ***	(0.0629)	0.2077	(0.0922)
Vietnam	USD	0.9625 ***	(0.0258)	0.6274	(0.0672)
	JPY	-0.0078	(0.0143)	-0.0147 ***	(0.0327)
	EURO	-0.0220	(0.0196)	-0.0002	(0.0538)
	CNY	0.0679 ***	(0.0248)	0.4177 ***	(0.0822)
	AUD	0.0082	(0.0206)	-0.0641	(0.0593)

Authors' calculation. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Note: All exchange rates are on a weekly basis, and we use NZD/USD exchange rates as a numéraire of Frankel and Wei (1994) regression Model.

Table 5 summarizes the results. The results of the FW regression model confirmed the following: Cambodia and Laos remain the countries closest to a dollar peg, but the US dollar's weight declined from 96.3% to 82.6% in Laos. Countries where the dollar's weight has decreased or become insignificant include Indonesia, South Korea, Malaysia, the Philippines, Thailand, and Vietnam. Among these, the RMB weight has increased in Indonesia, Malaysia, the Philippines, Thailand, and Vietnam. For the 2023-2025 period, Malaysia has the highest RMB weight (50.4%), followed by Thailand (49.5%) and Vietnam (41.8%). Furthermore, while only three countries—Singapore (Brunei), Thailand—had a positive and significant weight for the yen in 2017-2019, five additional countries—China, Indonesia, South Korea, Malaysia, and Thailand—joined them in 2023-2025. It is noteworthy that more Asian

countries added the Japanese yen to a basket of reference currencies during a period of significant yen depreciation. Our results show that a basket system comprising major currencies, the RMB, and the yen has been established in Singapore (Brunei), Korea, and Thailand. In summary, compared to the pre-pandemic period, many Asian currencies have recently seen a decline in their USD correlation weights, while the RMB and yen have seen increases.

5-2. Collect Each Country's Invoice Currency Share in Intra-Trade

In recent years, researchers in invoice currency have increasingly benefited from the authorities' publication of broader, more detailed datasets. At the IMF, Boz et al. (2022) analyzed a database of 115 countries to provide trade invoicing currency share data for each country since 1990 and confirmed the existence of the so-called "Dominant Currency Paradigm (DCP)" discussed by Gopinath et al. (2020). Their data shows that the U.S. dollar plays a dominant role in world trade. On the other hand, as suggested by Shimizu et al. (2022), the share of invoice currencies in a country's trade with the rest of the world is easily influenced by transactions with countries with large trade volumes. This is the downside of underestimating the use of emerging-market currencies, such as the Chinese yuan.

As Shioji (2006) noted, when determining optimal currency basket weights for a country, it is necessary to focus on the invoice currency used in trade transactions. As mentioned above, the US dollar, a third-country currency, is primarily used in intra-Asian trade. However, amid rising geopolitical risks in recent years, efforts to reduce excessive dependence on the US dollar and increase transactions denominated in domestic currencies, at least for intra-regional trade, are advancing in ASEAN countries, including China. Reflecting this backdrop, the importance of regional trade settlement currencies has grown significantly in recent years, with several countries publishing detailed data on the shares of invoice currencies. For example, Japan, Thailand, and South Korea have published data on invoice currency shares by trading partner, allowing us to observe the use of local currencies in intra-regional trade. China and Indonesia, while not bilateral, have also disclosed the share of invoicing currencies in their overall trade. By using these data, we aim to identify the recent trend in the share of invoice currency in intra-Asian trade.

5-3-1. Japan

The Ministry of Finance of Japan publishes semi-annually the shares of invoice currencies

by trading partner country/region[6]. This provided valuable insights into the currency choices of Japanese firms for their imports and exports.

Table 6. Trade Invoice Currency Share in Japan (First half of 2025)

	Destination	USD	Euro	JPY	LCY
Export to	World	50.4	5.9	36.5	2.0(CNY)
	Asia	46.4		46.3	3.6(CNY)
	China	40.1	0.3	47.9	11.6
	Korea	42.3	0.2	51.0	6.4
	Thailand	44.8	0.2	39.8	14.9
	Viet Nam	66.9	0.1	32.5	0.4
	Hong Kong	44.4		53.8	1.4
	Malaysia	42.3	0.2	54.7	2.7
Import from	World	67.4	3.3	25.3	1.9(CNY)
	Asia	69.1	0.4	24.2	3.8(CNY)
	China	71.0	0.5	20.1	8.1
	Korea	45.4	0.2	49.5	4.8
	Thailand	51.8	0.4	28.7	18.9
	Viet Nam	75.4	0.2	24.3	0.1
	Hong Kong	42.2	0.2	55.4	1.0
	Malaysia	76.1	0.5	20.9	1.4

Source: Ministry of Finance, Japan (https://www.customs.go.jp/toukei/shinbun/tuukahappyou.html)

Note: LCY refers to the local currency of each destination country.

Table 6 summarizes the results on invoice currency shares in intra-regional trade in the first half of 2025, indicating that while the yen's share of Asia's total exports is 46.3%, it is comparable to the dollar's share of 46.4%. On a bilateral basis, the yen's share surpasses that of the dollar in trade with China, South Korea, Hong Kong, and Malaysia. Similarly, for Asia's total imports, the yen's share is significantly lower at 24.2% compared to the dollar's 69.1%, but it is highest for imports from South Korea and Hong Kong. When examining local currency invoicing by partner country, Thailand has the highest share of Japanese exports invoiced in its own currency, at 14.9%, followed by China at 11.6%. For imports, Thailand has the highest share invoiced in its own currency at 18.9%, followed by China at 8.1%. As Shimizu et al. (2022) suggested, the share of Asian local currencies in Asian trade has been gradually increasing over the past few years.

6 The Japan Customs have begun publishing trade invoice currency share data by Japan's major trading partners on the Ministry of Finance website on July 28, 2023 (https://www.customs.go.jp/toukei/shinbun/tuukahappyou.html).

5-3-2. Thailand

The Bank of Thailand publishes invoice currency shares in regional and bilateral trade. Table 7 summarizes shares for global trade, Thailand-ASEAN trade, and Japan-Thailand trade. According to this, in intra-regional trade, the share of baht-denominated trade within ASEAN stands at 25% for exports and 13.0% for imports. Unfortunately, the share for trade with China is not published, but for global exports, RMB-denominated invoices account for 1.1%, and for imports, 3.8%.

Table 7. Trade Invoice Currency Share in Thailand in 2024

	Destination	USD	Euro	JPY	Baht	CNY
Export to	World	76.4	2.2	2.3	15.9	1.1
	ASEAN	71.7	0.5	0.5	25.0	-
	Japan	55.7	-	21.5	22.5	-
Import from	World	79.9	3.4	3.5	7.7	3.8
	ASEAN	83.2	0.5	1.1	13.0	-
	Japan	50.2	-	32.2	17.0	-

Source: Bank of Thailand

5-3-3. South Korea

The Bank of Korea also publishes regional and bilateral currency shares for trade invoices. Table 8 summarizes shares for global transactions, ASEAN transactions, and transactions with Japan and China. According to this, in intra-regional trade, the yen invoicing share is high for exports to Japan at 38.4% and imports from Japan at 43.4%. The RMB invoicing share is 7.1% for exports to China and 13.7% for imports from China. The won-denominated share is 6.2% for exports to Japan and 7.1% for imports from Japan, the highest within the region.

Table 8. Trade Invoice Currency Share in South Korea in 2024

	Destination	USD	Euro	JPY	Won	CNY
Export to	World	84.5	6.0	2.0	2.7	1.5
	Japan	54.9	0.5	38.4	6.2	-
	China	88.6	0.6	1.3	2.4	7.1
	Southeast Asia	95.8	0.5	0.3	1.8	-
Import from	World	80.3	5.7	3.7	6.3	3.1
	Japan	49	0.3	43.4	7.1	-
	China	80.9	1.3	0.6	3.4	13.7
	Southeast Asia	93.6	1.1	0.9	3.5	-

Source: Bank of Korea

5-3-4. Indonesia

The Bank of Indonesia only publishes the share of invoicing currencies in its total international trade. According to Indonesian data, the share of dollar-denominated trade in global exports is over 90%, while for imports, CNY-denominated trade accounts for 8.8%, rupiah-denominated trade for 3.1%, and yen-denominated trade for 2.2%. Interestingly, the share of RMB invoicing transactions in Indonesia's total trade is higher than that of other Asian countries introduced thus far. Since RMB invoicing is primarily used in trade with China, for example, Indonesia's trade share with China accounts for approximately 25% of its imports. Calculating this, RMB invoicing share in imports from China is expected to be around 35%, which is four times the 8.8% share. (Table 9)

Table 9. Trade Invoice Currency Share in Indonesia in 2024

	Destination	USD	Euro	JPY	Rupiah	CNY	SGD	Baht	MYR
Export to	World	92.3	0.7	0.9	1.2	3.5	0.4	0.1	0.1
Import	World	76.1	3.6	2.2	3.1	8.8	1.6	0.3	0.3

Source: Bank of Indonesia

5-3-5. China

The State Administration of Foreign Exchange in China discloses China's data encompasses both trade and capital transactions. The RMB share of global receipts stands at 46.2%, while the RMB share of global payments is 52.2%, representing roughly half of the total. (Table 10)

Table 10. Trade Invoice Currency Share in China in 2024

	Destination	USD	Euro	JPY	CNY	HKD	Others
Receipt	World	46.2	1.9	0.5	46.2	0.8	0.3
Payment	World	41.8	2.5	1.1	52.2	1.1	1.3

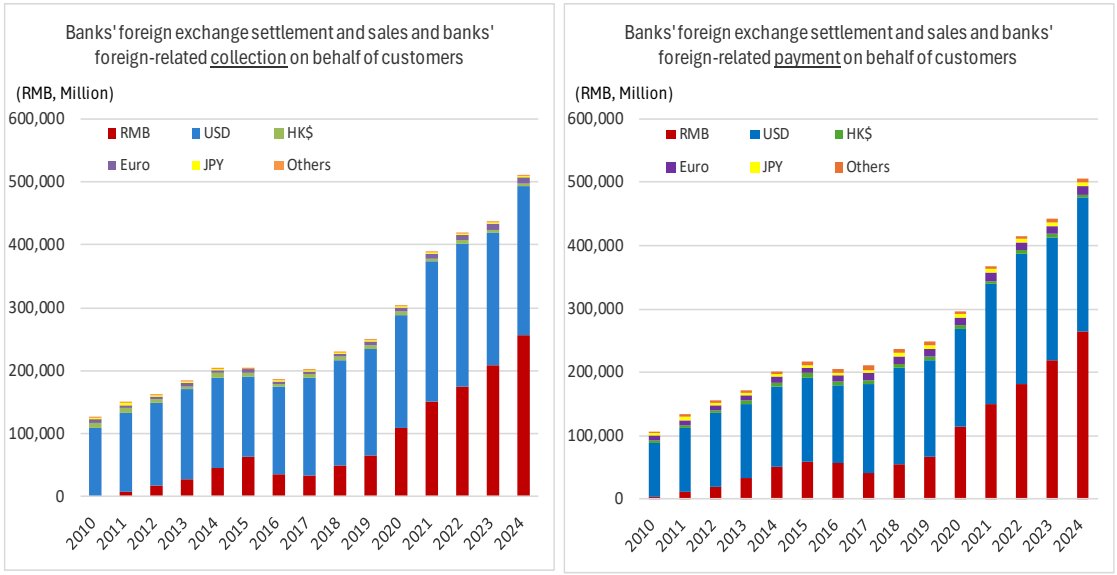
Source: State Administration of Foreign Exchange, China

Note: This data includes both trade and financial account transactions.

In addition to the above trade and capital transaction data, China's State Administration of Foreign Exchange publishes currency breakdowns (RMB, USD, HKD, EUR, JPY, and others). These figures cover all external transactions conducted through banks, including both

current account and capital account balances. According to Figure 5, since the initiation of RMB-denominated external settlements in 2010, the volume of RMB-denominated transactions has increased every year except 2016 and 2017, with the growth rate accelerating particularly since 2020.

Figure 5. Banks' foreign exchange settlement and sales, and banks' foreign-related collection and payment on behalf of customers

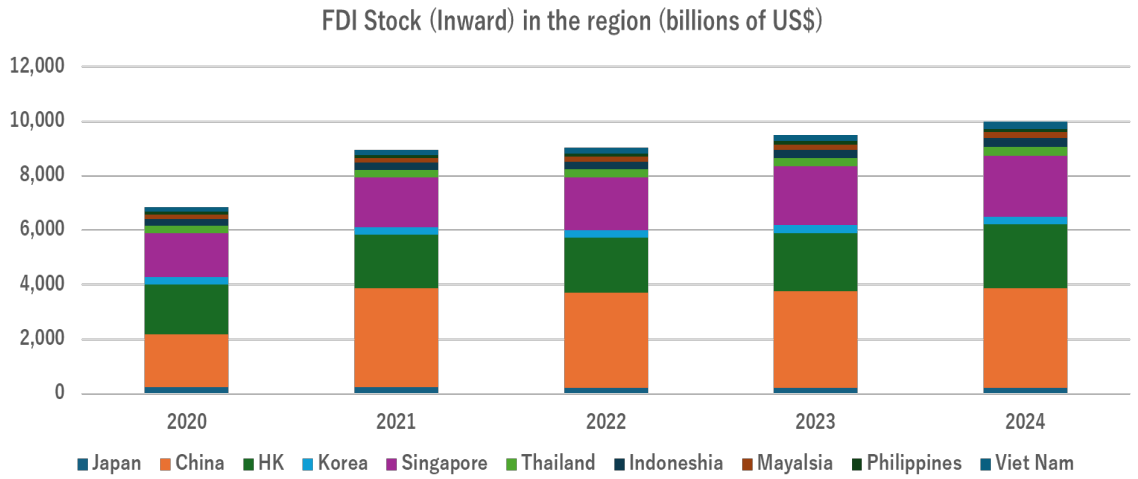


Source: State Administration of Foreign Exchange, China

5-3. Cross-Border Investment in the Region

As McCauley and Chang (2018) indicate, financial links play a crucial role in influencing currency co-movement by connecting economies through investment flows, portfolio behavior, and market correlations. In this paper, we focus on cross-border investment flows, particularly FDI, which is a longer and more stable capital flow compared with portfolio investments, and try to create cross-border investment data in the region. Using data from UNCTAD, the IMF, and the Ministry of Japan's Statistical Bulletin of FDI in China 2024, Figures 6 and 7, and Table 11 aggregate the portion of each country's inward FDI data representing investment originating from other countries within the region.

Figure 6. FDI Stock (Inward) within the Region (billions of US$)

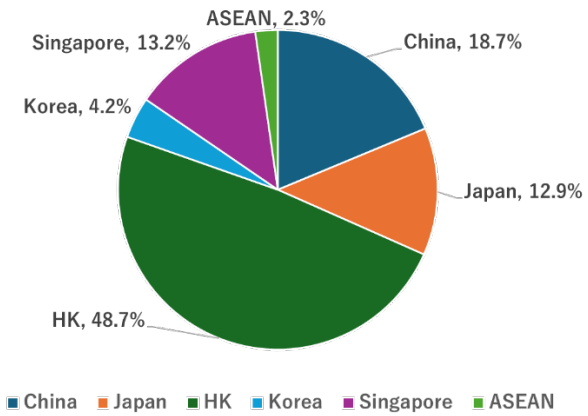


Source: UNCTAD

Table 11. Region and Countries' Share of Inward FDI Positions within the Region as of 2024

	Japan	China	HK	Korea	Singapore	Thailand	Indonesia	Malaysia	Philippines	Vet Nam
Inword FDI Stock (billions of US$)	220	3,650	2,351	287	2,231	337	306	223	126	249
Share from the region	26.6%	72.0%	32.6%	44.4%	17.7%	67.1%	88.2%	55.6%	42.2%	74.8%
from China	1.3%	-	31.1%	16.7%	2.4%	5.5%	8.1%	3.7%	4.4%	8.4%
from Japan	-	4.6%	1.5%	17.7%	6.4%	27.6%	21.1%	10.2%	15.8%	13.8%
from HK	8.1%	59.2%	-	2.9%	3.9%	8.5%	7.6%	13.3%	0.6%	9.3%
from Korea	2.7%	2.2%	0.0%	-	1.6%	1.3%	4.5%	2.9%	7.4%	19.1%
from Singapore	14.0%	6.0%	1.9%	7.0%	-	22.6%	42.4%	25.4%	12.6%	20.0%
from ASEAN (excl. Singapore)	0.5%	0.0%	0.0%	0.0%	3.5%	1.6%	4.5%	0.0%	1.5%	4.2%
Source: Unctad, IMF, STATISTICAL BULLETIN OF FDI IN CHINA 2024										

Figure 7. Investment country's share of Inward FDI within the region as of 2024 (%)



Source: UNCTAD, IMF, Statistical Bulletin of FDI In China 2024

Summarizing trends in inward foreign direct investment within Asia reveals the following. Within the region, China receives the most inward FDI, followed by Hong Kong and Singapore. The highest inward FDI ratios from within the region are in Indonesia (88.2%), followed by Vietnam (74.8%), China (72.0%), and Thailand (67.1%). China and HK each have the highest direct investment from their respective countries. Approximately 60% of inward FDI into China originates from HK. The countries with the highest share of FDI from Japan are Thailand (27.1%), South Korea (17.7%), and the Philippines (15.8%). Singapore directs significant FDI to neighboring ASEAN countries, with the highest shares going to Indonesia (42.4%), Malaysia (25.4%), and Thailand (22.6%).

Intra-regional inward FDI shows a gradual upward trend, with substantial inflows originating from China, HK, and Singapore. The proportion of FDI into the region originating from Hong Kong and Singapore is high. This is likely because funds from other advanced economies, including Western countries, and from China, which are channeled through these two major Asian international financial hubs—Hong Kong and Singapore—are supplying FDI capital within the Asian region. We plan to analyze this point further, including identifying the true source countries of these investments.

6. How to Capture the Production Network and Value Chain

We used trade volume and GDP to determine AMU weights. Trade volume is the total value of a country's exports and imports combined. One reason for using trade volume is that it reflects the scale of trade settlements and can significantly influence fluctuations in national currency exchange rates against international currencies. In addition, the size of GDP directly affects trade volume. However, recent developments of production networks within the region

mean that a country's exports and imports may no longer accurately reflect its underlying economic activity. As mentioned in section 2, Japan's decline in its intraregional trade share is largely due to the relocation of Japanese companies' production bases to Asia. Then, what implications arise when calculating AMU weights based on trade volume in a traditional bilateral trade model? This section examines how recent changes in production activities, such as supply and value chains, affect the relative weights of individual countries when AMU weights are based solely on trade volume.

For example, consider a case where a product is manufactured through a supply chain spanning three countries from Country A to Country C, and that product is sold as a final good in Country D (Case 1, Table 12). Assume Country A imports materials from outside its supply chain to produce the initial components of its product. At the first stage of the supply chain, Country A adds 20 units of value and exports them to Country B, which conducts the next production step. Country B imports semi-finished goods worth 70 units from Country A. Through its production activities, it generates an additional 10 units of value and exports to Country C, which handles the subsequent production process. Country C also creates 10 units of value, but its product is first exported back to Country A. Country A imports 90 units from Country C, then adds 110 units of value during manufacturing to produce the final product, which is exported to the final consumption destination, outside the region Country D*. This final stage likely involves significant margins, reflecting factors like marketing and brand value. Table 12 displays the trade balance, trade volume, and the corresponding AMU weights derived from this supply chain manufacturing process.

Table 12: All three countries are included in the production (Case 1)

Case 1	Process	Country A		Country B	Country C	Country D*
Product Value=150 =200－50	Export	70	200	80	90	0
	Import	50	90	70	80	200
	Trade Balance	+130		+10	+10	-200
		86.70%		6.70%	6.70%	-
	Trade size	410		150	170	200
		56.10%		20.50%	23.30%	-

Authors' calculation

As shown in Table 12, Country A, which exports final products, has the largest trade surplus. Meanwhile, when examining each country's share of total trade volume, the weight of Countries B and C in the supply chain increases relative to their share of the trade surplus.

Furthermore, although both Countries B and C generate the same amount of added value, Country C's trade volume, which is located downstream in the supply chain, is larger than Country B's. This indicates that, when calculating AMU weights based on trade volume, downstream countries in the supply chain receive higher weights than upstream countries.

Next, in Case 2-1, we assume that Country A within this supply chain hosts the company's headquarters and R&D department. However, we further assume that while this company's headquarters and R&D department oversee all aspects of the product's planning, design, and manufacturing investment, they do not participate in the actual manufacturing process.

In this case, in Table 13, Country A's exports and imports are zero. Meanwhile, Country B imports the initial components for manufacturing from a country outside the supply chain and adds 30 in value-added. That is, in Case 1, Country B is assumed to undertake the initial manufacturing process that Country A previously undertook. Country B exports 80 units as semi-finished goods to Country C. Country C performs the same production activities as before, adding 10 units of value-added to bring the product value to 90. However, the final manufacturing process previously performed by Country A in Case 1 is transferred to Country C in Case 2-1. Exports to the final consumption destination, Country D*, are also made from Country C. At this point, the product is exported from Country C to Country D* at a final price of 200, with a 110 price margin.

Table 13: Country A is excluded from the manufacturing process (Case 2-1)

Case 2-1	Process	Country A	Country B	Country C	Country D*
Product Value=150 =200－50	Export	0	80	200	0
	Import	0	50	80	200
	Trade Balance	0	+30	+120	-200
		0%	20%	80%	-
	Trade size	0	130	280	200
		0%	31.70%	68.30%	-

Authors' calculation

In such cases, Country A does not engage in the export or import of goods and services and is therefore not included in the calculation of the AMU weight.

Conversely, Country C, located at the very end of the supply chain, now manages exports to the final consumption destination, Country D*, on behalf of Country A. As a result, Country C holds the largest share and volume in both the trade balance and trade volumes. This occurs

even though no additional value from marketing activities that boost the product's brand or from sales efforts is created in Country C. When such manufacturing processes are involved, the trade balance and trade volume differ considerably from those in Case 1. Therefore, the AMU weight reflecting these figures diverges significantly from the actual revenue earned by the global company.

When analyzing the manufacturing processes of companies within such supply chains, it is crucial to include the concept of value-added trade in calculating the AMU. Case 2-2 demonstrates the production activities from Case 2-1 using value-added trade. Since the value added in each country ultimately equals that country's trade balance amount, calculating AMU shares based on the magnitude of value added results in the same shares as those based on trade balance amounts in Case 1. (Table 14)

Table 14: Supply chains and value-added trade (Case 2-2)

Case 2-2	Process	Country A	Country B	Country C	Country D*
Product A Value=150	Designing	+100	0	0	0
	R&D	+30	0	0	0
	Key parts producing	0	+10	0	0
	Assembling	0	0	+10	0
	Total	+130	+10	+10	-150
		86.70%	6.70%	6.70%	-

Authors' calculation

Therefore, measuring each country's production activities using value-added trade amounts accurately reflects their actual economic scale and activities. It also provides an important perspective for the AMU to further promote cross-border economic activities in Asia by supporting exchange rate stability. However, calculating AMU weights based on value-added trade amounts requires developing new data from scratch. As a result, this paper leaves this task for future research.

Conversely, when considering the value chain — beyond just the export and import supply chains — in the business activities of global enterprises, it may also be possible to include the size of each country's receipts, payments, and primary income balance in the balance of payments, driven by corporate activities, in the AMU weight calculation.

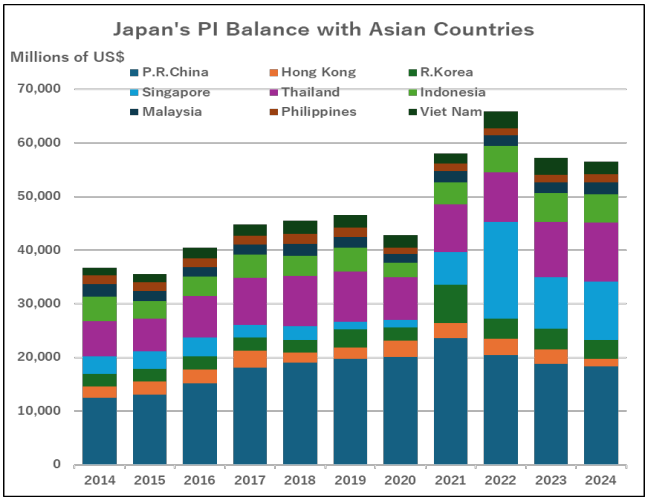
Then, how do we capture the above idea from the current published trade statistics? As Xu (2011) suggests, the optimal currency basket should take vertical trade conditions into

account. Furthermore, this raises the question of whether trade weight should be calculated simply as the sum of imports and exports. As we know, GDP does not include income received from abroad, such as income earned by overseas branches through business activities abroad. Trade (transaction) amounts tend to increase significantly as they move downstream in the supply chain.

As one approach, we can investigate each country's primary income flow within the region. Unfortunately, only Japan and South Korea currently publish data that clearly distinguishes which countries send primary income. Meanwhile, examining the primary income balance of the ASEAN+4 countries reveals that most nations, excluding Japan and South Korea, have negative balances. Accordingly, this paper focuses on data from Japan and South Korea, which have positive income balances from within the region[7].

According to Figure 8, the largest source of primary income received from countries within the region is China, followed by Singapore and Thailand. However, since the pandemic, receipts from China have decreased, while receipts from Singapore have surged. Japanese manufacturing companies operating in Asia often establish their regional headquarters in Singapore, indicating that PI receipts via Singapore are on the rise. Many Japanese companies also have local subsidiaries in Thailand and Indonesia, and they consistently receive stable PI flows from these entities.

Figure 8. Japan's PI Balance with Asian Countries

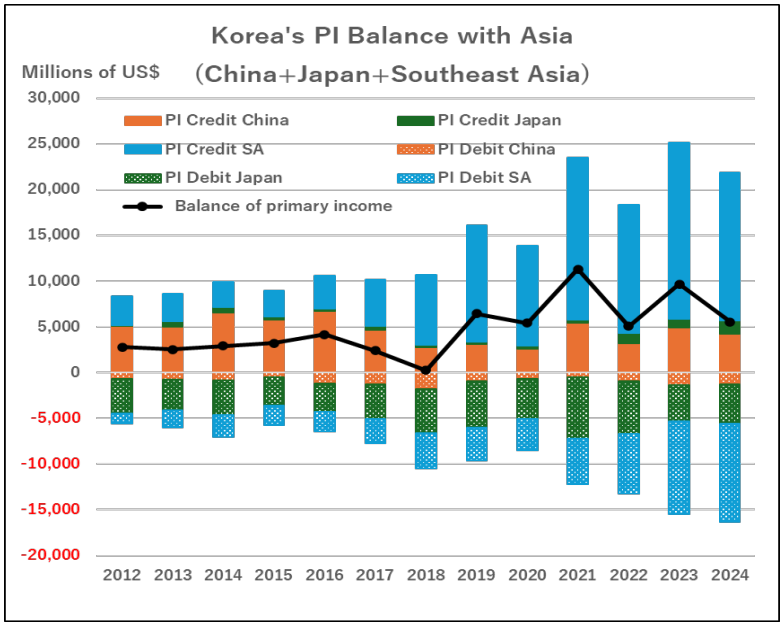


Source: Ministry of Finance, Japan.

[7] Japan's data presents the PI Balance amount by country, while South Korea's data is broken down into Primary Income Credit and Debit, categorized by country and region.

Figure 9 shows both Korea's receipts (credit) and payments (debit) for primary income. It indicates that Korea's receipts exceed its payments from China and Southeast Asia, with receipts from Southeast Asia being particularly increasing since 2018. Conversely, Korea has a net payment position toward Japan.

Figure 9. Korea's PI Balance with ASIA (China+Japan+ SA)



Source: Bank of Korea.

7. Summarizing the Results

In this paper, we explore new possibilities from the perspective of what is required to construct a new basket weight for the AMU. Drawing on prior research and the current expansion of production networks within the region, it analyzed the impact of factors such as recent exchange rate policies in Asian countries, the use of their own currencies for trade invoicing, intra-regional capital flows (FDI), and primary income flows within the region.

As we have seen, when we determine the AMU basket weights by considering new factors, we have summarized the degree to which the new elements positively impact the basket weights in Table 15. Regarding financial openness, *KAOPEN* shows that Japan, Singapore, and Hong Kong are far more advanced than China, despite China's superiority in the real economy. Regarding exchange rate policies, given that many Asian countries have increased their pegs to the RMB, several countries also peg to the Yen, and Brunei pegs to the Singapore Dollar, we determined that this would positively impact China, Japan, and Singapore, respectively. Regarding the share of currencies used for trade settlement within the region,

excluding the dollar, the yen has the highest share, followed by the RMB and the Baht, whose shares have been growing in recent years. This suggests a positive impact on Japan, China, and Thailand, respectively. Considering the flow of capital within the region, such as inward FDI, the positive effect was observed in five countries: Hong Kong, which sent the most significant amount, followed by China, Japan, Singapore, and, thirdly, South Korea. Lastly, among primary income receipts in the region, Japan received the most, followed by South Korea, with a notable difference between the two.

Considering the above factors, Japan has the most positive items, followed by China, compared with the AMU weight calculated using traditional intra-regional trade volume and GDP measured by purchasing power parity. Smaller countries, such as Hong Kong and Singapore, are also recognized as international financial centers. South Korea, which benefits from increased intra-regional direct investment and positive primary income receipts, and Thailand, where the share of baht-denominated transactions remains robust due to the promotion of its own currency, the baht, also receive positive adjustments.

Table 15. Possible Candidates for AMU Basket Weights and Their Effect

	Trade Volume	PPP-GDP	Financial Openness	Exchange Rate Policy	Invoice Currency Share	Intra Inward FDI	Intra PI Balance
Brunei	0.26	0.07					
Cambodia	0.61	0.18	+ +				
China	35.27	61.57		+ + +	+ +	+ +	
Hong Kong			+ + +			+ + +	
Indonesia	5.37	8.01					
Japan	14.6	12.27	+ + +	+ +	+ + +	+ +	+ + +
Korea	12.42	5.38	+ +			+	+
Lao	0.34	0.14					
Malaysia	6.72	2.27					
Myanmar	0.57	0.61					
Philippines	1.5	2.28					
Singapore	8.8	1.48	+ + +	+		+ +	
Thailand	5.6	3.11			+		
Viet Nam	7.95	2.64					

Current AMU Weights* Possible Candidates for Basket Weights

* Current AMU weights are from the RIETI Website.

8. Conclusion

We confirm the recent conditions of Asian countries as follows. Using the G-PPP Model, we confirm that the OCA conditions are not met in all ASEAN+5 countries, but that some combinations (7 to 9 countries among 12) meet them. Increasing the number of Asian sample countries reaffirmed that countries integrated into supply chains, such as Vietnam, are a key factor in generating OCAs in Asia. Regarding countries, China surpassed Japan in the number of OCA combinations, confirming China's position as the centre of Asia.

In intra-regional trade, the use of Asian local currencies such as the RMB and baht is increasing alongside the yen. Accordingly, the share of RMB pegs is rising in the exchange rate policies of Asian countries. As we examine, the AMU basket weights can incorporate not only traditional trade weights and GDP but also factors such as each country's exchange rate policy, the share of invoicing currencies in intra-regional trade, the share of intra-regional FDI, and the share of intra-regional Primary Income. Incorporating these new elements suggests the potential for positive weight adjustments in countries such as Japan and South Korea, whose AMU basket weights have declined, and Singapore, whose weight was previously low due to its smaller size. Thailand, which promotes transactions denominated in its own currency, would also benefit. Further consideration is needed regarding the quantification of the new factors and whether the share of each factor after incorporation should be treated as an arithmetic mean or a weighted average.

Regarding Asian production networks and the value chain, this paper has simply substituted primary income data to compensate for the inadequacies of traditional trade statistics. However, in the future, it will be necessary to construct more comprehensive data using value-added trade and/or Input-Output Tables to address basket weights. Similar to vertical trade, we would like to develop a method to classify inward FDI within the region that is invested from other countries via international financial markets such as Hong Kong and Singapore.

This paper examined the OCA across 12 Asian countries and found that not all currently meet the OCA criteria. Although using the OCA criteria to determine the target countries for the AMU is a sound approach, we have tentatively identified 14 nations as targets for this phase. Further discussions on this matter will be necessary. Additionally, we want to expand our OCA analysis by including neighboring Oceania countries. We will also explore the potential for expanding the currency area.

Finally, we do not explicitly discuss differences in prices and interest rates across Asian countries. However, the inflation gap between Japan and other Asian countries is significant, and it may be necessary to adjust the macroeconomic variables used to construct the basket

weights to account for this difference. This point should be addressed as a future task.

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